MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

TCP2451 – PROGRAMMING LANGUAGE TRANSLATION / TCS3311 – COMPILER DESIGN

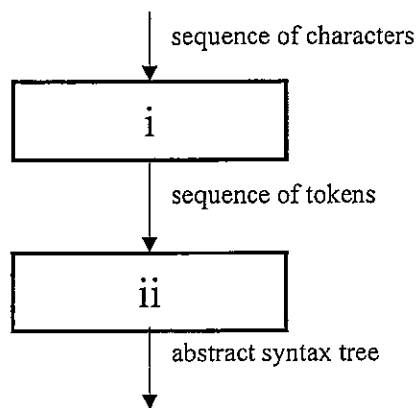(All sections / Groups)

12 MARCH 2018
9:00 a.m. – 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of **5 pages** only including the cover page with 4 Questions.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print all your answers **CLEARLY** in the Answer Booklet provided.

Question 1 (0.5+2+2+4+4 marks)

(a) What is the definition of programming language translation?

(b) Give one programmming language name example for each of the following translator categories.
   i. Compiler
   ii. Interpreter

(c) Consider the following diagram inside a compiler.

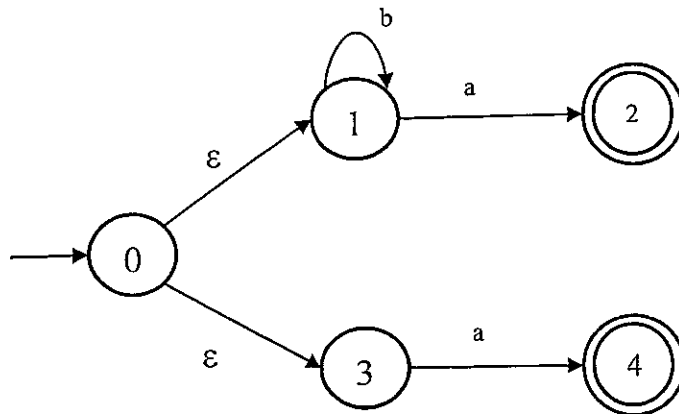Give the two missing components labelled i and ii.

(d) Use a programming language to illustrate an example of hybrid translator.

(e) Why do we need symbol table and error handler in all the phases of a compiler?

Continued.......

Question 2 (9+3.5 marks)

(a) Consider the following NFA.

  i. Explain ε-closure of a state using an example from this NFA.
  ii. Convert the NFA to a DFA using subset construction algorithm. Provide all the necessary steps and the transition table.

(b) Consider the following grammar.

  F → T X
  T → (F) | int Y
  X → + F | ε
  Y → * T | ε

  i. Find the set for the FIRST(X).
  ii. Find the set for the FIRST(Y).
  iii. Find the set for the FOLLOW(X).
  iv. Find the set for the FOLLOW(Y).

Continued.......

Question 3 (3+5+3+1.5 marks)

(a) Consider the following Java code.

```
class A {
  public static void main(String[] myargs) {
  }
}
```

Give all the tokens (lexemes and its corresponding types) in table form.

(b) Consider you are given one of the following top-down parsing table non-terminal rows.

	num	−	(	)	$
E'		→ (E)			→ ε

Write the `parse_EPrime()` procedure using a high-level programming language such as Java.

(c) Give a regular expression to define each of the following in JLex specification format.
  i. letter of English alphabet
  ii. digit
  iii. Java identifier

(d) Give three out of four section names of Java CUP specification file.

Question 4 (2+5+4+1.5 marks)

(a) Give the input and output of the semantic analysis of a compilation process.

(b) Convert the arithmetic expression (a + b * c) into each of the following.
    i. syntax tree
    ii. three-address code
    iii. quadruples
    iv. triples
    v. indirect triples

(c) Construct both the unoptimized syntax tree and directed acyclic graph (DAG) respectively for the expression (a + b + (a + b)).

(d) Consider the following machine instruction sequence.

```
MOV j, R0
ADD #1, R0
MOV R0, j
```

Convert the machine instruction sequence to Java statement.

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